Assessment of the Digital Cadastre in Nepal from the Cadastre 2014 Vision

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Key words: digital cadastre, cadastre 2014, data model, land administration, SDI, evaluation

SUMMARY

In Nepal, the value and price of land in urban areas is very high. Due to the scale constant, the cadastral maps prepared by graphical cadastral surveying method does not satisfy the land owners as they are asking for the accuracy of centimeter of land in the front face of their land parcel. The land owners are also asking for the recording and documentation of 3D real estate objects. Considering these facts, Cadastral Survey Branch under Survey Department has initiated for digital cadastre program focusing on the urban land areas to provide land tenure security. Last year, the piloting of this program has been successfully completed in preparing digital cadastral database in ward no six of Banepa Municipality, Nepal. After the success of digital cadastral mapping, the programme has been continued and some observations are made. Some lessons have been learned from this programme for the cadastral information system (CIS) development in Nepal. There are various ways to evaluate the cadastral projects. In this paper an attempt has been made to evaluate the digital cadastre programme from Cadastre 2014 perspectives.

This paper starts with introduction and background for the initiation of digital cadastre programme in Nepal. It then describes about evaluation methods for cadastral system. It also describes about the background and context to evaluate digital cadastre from the cadastre 2014 perspectives. It compares the digital cadastre system of Nepal with six statements of the Cadastre 2014 report. Finally, it concludes with some conclusions.

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1. INTRODUCTION

In Nepal, Ministry of Land Reform and Management (MLRM) is responsible for the administration and management of land through its central Departments and District Offices. Survey Department (SD) is one of the departments under MLRM responsible for the initial land registration and cadastral surveying. Cadastral Survey Branch under Survey Department is responsible to carryout adjudication of land ownership rights, identify and survey land parcels/objects and owners, prepare cadastral maps, classify land parcels, prepare and issue the land ownership certificates. In the beginning, cadastral surveying was sporadic in nature but later systematic cadastral survey was began to support the land reform programme launched by Nepalese Government. The cadastral maps were prepared using chain survey and plane tabling survey method. Those maps were mainly prepared for fiscal purposes. Due to urbanization and population growth, the value of land is increasing rapidly. The graphical cadastral maps are not adequate to reflect the real field situation in the urban areas as the value and price of land in urban areas is very high. Due to the scale constant, the cadastral maps prepared by graphical cadastral surveying method does not satisfy the land owners as they are asking for the accuracy of centimeter of land in the front face of their land parcel. The maps are in very ruin condition due to the continuously used and improper documentation. The land owners are also asking for the recording and documentation of 3D real estate objects. They are not able to satisfy the demand of land owners. Considering these facts, SD has prepared its Logical Framework Plan (10 years from fiscal year 2005/2006) and one of the outputs after ten year will be the replacement of traditional technology with digital cadastral system for effective service delivery in cadastral related organizations in Nepal (Survey Department, 2006). Cadastral Survey Branch under Survey Department has introduced digital technology for data acquisition in urban areas as a piloting. After the success of this technology in piloting phase the program has been continued and improvements are going on. The traditional plane tabling method has been replaced by modern numerical cadastral surveying method using total station instruments and the cadastral database has been developed in fully digital environment. Some lessons have been learned from this programme for the cadastral information system (CIS) development in Nepal. There are various ways to evaluate the cadastral projects. In this paper an attempt has been done to evaluate the digital cadastre programme of Nepal from Cadastre 2014 perspectives

2. EVALUATION TRENDS

There are various methods in practice for the evaluation of cadastral systems. Currently there is no accepted framework or methodologies to compare and evaluate national cadastral system. The evaluation of cadastral system demonstrates strength and weaknesses of the current system, gives the justification for the improvement, and identifies priorities in policy,

management & operations. Several development agencies use a method called "Logic Framework Analysis" (LFA) as a classic tool of aid management to investigate and evaluate projects and programs in the field of aid development (Steudler and Rajabifard, et al. 2004). The first attempt for benchmarking of cadastral system was started by Australian Surveyor in 1997. The FIG Commission 7 working group has published a Report of Benchmarking Cadastral System in 2002 covering the scrutiny of the international renowned personalities. In the same way Cadastral Template is another document to measure the performance of cadastral organizations. Dr. Steudler has developed a framework and methodology to carry out comparisons and evaluations of Land Administration system taking economic, social and environmental issues into consideration in his PhD dissertation (Steudler, 2004). The Cadastre 2014 document is another tool to evaluate the modern cadastral project of a country. Various research results show that the vision for Cadastre 2014 is also applicable for the cadastral projects supported by ICT in developing countries (van der Molen, and Lemmen, 2003; Hawerk, 2006; Kaufmman and Steudler 2004 , Lemmen et al, 2003). In this paper an attempt has been made to evaluate digital cadastre of Nepal from the Cadastre 2014 perspectives.

3. BACKGROUND AND CONTEXT

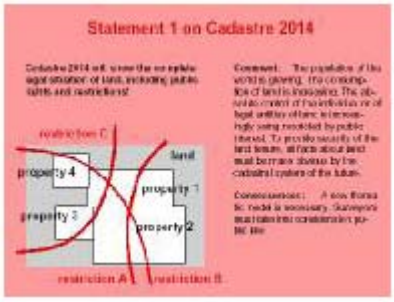
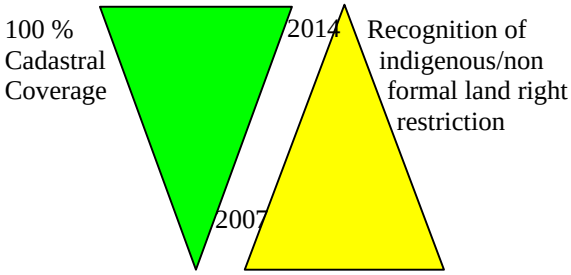
When I was studying GIM2 course (2003-2005) in ITC, the Netherlands, I got the opportunity to study and understand Cadastre 2014 report. Most of the students including me were from developing countries. We discussed each other and concluded that none of the statements are relevant for the cadastral related organizations of developing countries. We concur with this document knowing that the vision was developed in the case of developed countries. It was the case of only three years back. After returning from ITC, I am involving in digital cadastre programme run by Cadastral Survey Branch of Survey Department. Now, I have courage to evaluate this programme with cadastre 2014 vision. I need to salute to the then Working Group 1 of FIG-Commission 7 for formulating this vision. Actually, the group was commissioned to: *Study cadastral reform and procedures as applied in developed countries, about taking consideration automation of the cadastre and the role of cadastre as part of a larger land information system, evaluate trends in this field and produce a vision of where cadastral systems will be in the next twenty years, show the means with which these changes will be achieved and describe the technology to be used in implementing these changes.* The working group submitted the booklet "Cadastre 2014 – A Vision for a Future Cadastral System" and basically formulated six vision statements for a future cadastral system (Kaufmann and Steudler, 1998) to the XXII FIG Congress in Brighton in 1998. Since then, a lot of discussions are going on and it is becoming an important theme for the discussions on conference/seminars and lecture rooms among professionals as well as academicians. The booklet is becoming a sacred document for cadastre/land registry related organizations all over the world. Primarily, the vision was developed focusing the future cadastral system of developed country assuming that developing and transitional countries would adopt the traditional methods. Coming on the half of the way, developing countries are also initiated cadastre project using latest Geo-ICT technology (Kaufmann, 2002). The Cadastre 2014 document is becoming much more relevant for the cadastral related organizations all over the world as the year 2014 is coming near to nearer. The cadastral related organizations are benchmarking as well as preparing strategic plan based on this document. The affordable

Geo-ICT (internet, geo- database, modeling standards, open systems, GIS etc) is available every where. The developing and transitional countries are making use of latest technologies. It is becoming easy for those countries having no or less infrastructure to modernize their cadastral system from zero level using these affordable Geo-ICT tools. Hence, the Cadastre 2014 document has been taken as a base for the evaluation of digital cadastre programme of Cadastral Survey Branch.

4. EVALUATION WITH SIX STATEMENTS

According to the definition of Cadastre 2014, Cadastre 2014 is a methodically arranged public inventory of data concerning all legal land objects in a certain country or district, based on a survey of their boundaries. Such legal land objects are systematically identified by means of some separate designation. They are defined either by private or by public law. The outlines of the property, the identifier together with descriptive data, may show for each separate land object the nature, size, value and legal rights or restrictions associated with the land object. In addition to this descriptive information defining the land objects, Cadastre 2014 contains the official records of rights on the legal land objects (Kaufmann, Steudler 1998).

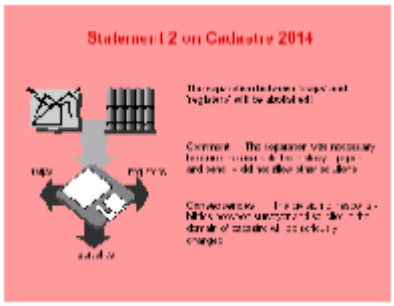
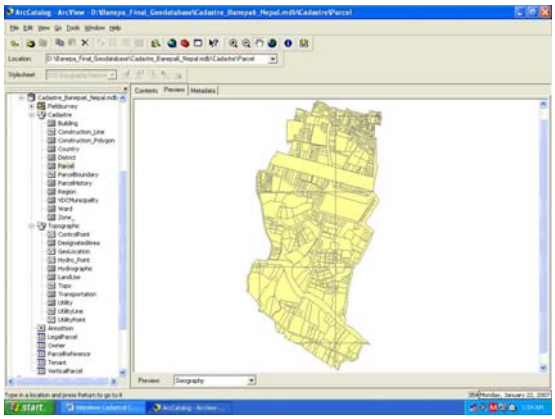
In this section, the digital cadastre program of Nepal has been assessed from the six vision statements of Cadastre 2014. The evaluation is based on the author's own experience as he is involving on this program. The technological innovations are predicated based on today's perspectives. All six statements are explained and digital cadastre programme has been evaluated based on these statements. Finally, some observations are made.

Statement	Cadastre 2014 (From Cadastre 2014 booklet)	Cadastre 2014 (Digital Cadastre view)
One	**Cadastre 2014 will show the complete legal situation of land, including public rights and restrictions!** 	**Cadastre 2014 will show the complete legal situation of land, including public rights and restrictions (including indigenous/non-formal land object rights and restriction)** 

Explanation: As land becomes a scarce resource and more and more public rights and restrictions influence the private landownership, the cadastral system of the future needs to show the complete legal situation in order to provide the required land tenure security.

Evaluation: In Digital Cadastre of Nepal, complete documentation of the legal situation of land has been addressed. The surveyor verifies and validates the information about the land objects during adjudication. The land objects are delimited and all the rights and restrictions on the land objects are recorded, registered and modeled to provide the land tenure security. The land information thus prepared could provide the legal security for financial institutions for the purpose of mortgage. Digital cadastre is based on the principal of multipurpose cadastre so all the field details are captured during cadastral surveying. For example, if there are informal settlements, the huts are also shown on the cadastral maps. Spatially, it has addressed the complete legal situation of land. It also has opened the door to recognize indigenous/non-formal land object rights and the restriction according to new laws concerning physical planning, environmental protection, land use and the exploitation of natural resources. Being based on the existing land laws the restriction according to new laws has not addressed much but has kept the room to address these issues.

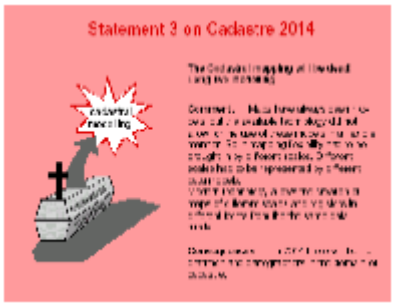
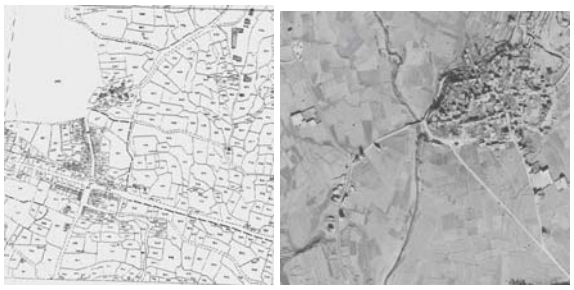
Observation: In my observation, in 2014 (from digital cadastre programme perspectives) it will show the complete legal situation of land, including public rights and restrictions! If there is no cadastral map, the legal situation of land will be incomplete. The land right issue of informal settlers/indigenous people is the concern of Nepalese Government. Hence, cadastre 2014 will have the 100% of cadastral coverage of whole country and address the issue of indigenous/non-formal land object rights and restriction according to the new laws.

Statement	Cadastre 2014 (From Cadastre 2014 booklet)	Cadastre 2014 (From Digital Cadastre)
Two	**The separation between 'maps' and 'registers' will be abolished!** 	**The separation between 'maps' and 'registers' will be abolished!** 

Explanation: The separation was historically necessary because of the available technology at the time, but this can nowadays be overcome, at least technically if not institutionally as well.

Evaluation: In Digital Cadastre programme of Nepal, the digital cadastre team performs adjudication, cadastral surveying, land registration, cadastral database preparation and land ownership certificate distribution. In the beginning, there is no separation between maps and registers as both the documents are prepared by the same organization. The documents will be separated only after handed over the documents to the respective district land registry and cadastral office. Hence, technically being the same source and standard sharing and integrating of data is possible with the modern Geo-ICT tools that will be available. Institutionally, It will force to amalgamate both organizations into a single organization. Nepalese government has given priority for the service delivery through one door policy. The ICT tools will make easy to integrate both spatial and non-spatial data related to land. The digital cadastre office will be single point of contact for cadastral information. The role of surveyors will be more and lead for land administration.

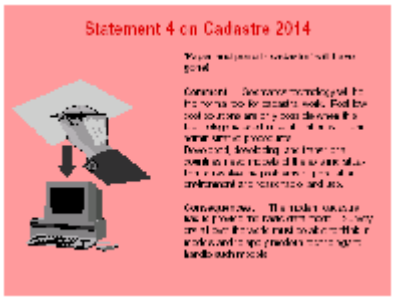
Observation: In my observation, the separation between 'maps' and 'registers' will be abolished in 2014. There are two possibilities either two cadastral and land registry organizations will be merged institutionally /technically or the land administration work (at least operational work) will be deputed to local authority (Municipality or Village Development Committee).

Statement	Cadastre 2014 (From Cadastre 2014 booklet)	Cadastre 2014 (From Digital Cadastre)
Three	**The Cadastral mapping will be dead! Long live modeling!**  	**The Cadastral mapping will be dead! Long live modeling!**  **DEAD** **LIVE**

Explanation: The production of plans and maps has always been the main objective and responsibility of surveyors; modern concepts and technology provide different and much more advanced opportunities, which surveyors need to acknowledge by adopting principles from information technology.

Evaluation: The Digital cadastre is based on the principal of multipurpose cadastre. Land Owners could trust more on images and models rather than on maps. The ortho photo/high resolution satellite imagery could be very useful tool during adjudication and land registration. Land owner could be more faith on the aerial photographs or satellite imagery as they could visually interpret their parcel boundary. During numerical cadastral surveying, the land objects are described by 3D co-ordinates so the 3D real estate objects will be described by 3D model. A detailed specification for Cadastral Information Service (CIS) and National Cadastral Database (NCDB) has been prepared and the core cadastral model has been developed. It will be very easy for the users to access and use the cadastral information. The NCDB will be important component for the development of NSDI.

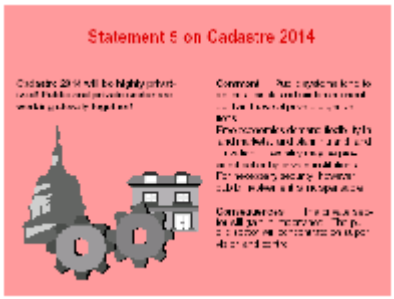
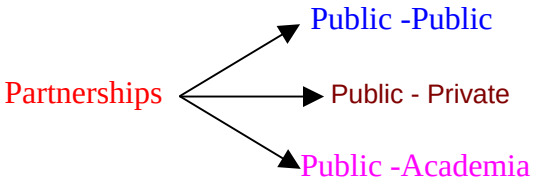
Observation: In my observation, the cadastral model will be used for adjudication, land registration and to resolve the boundary disputes. The land objects are described by 3D co-ordinates and the spatial context of parcel history has been maintained. The concept of 3D and 4D will be come under practice. Surveyor will use the low cost products like Google Earth and open source tools in cadastre 2014. Cadastral database will help for the development of NSDI throughout the country.

Statement	Cadastre 2014 (From Cadastre 2014 booklet)	Cadastre 2014 (From Digital Cadastre view)
Four	**'Paper and pencil – cadastre' will have gone!** 	**'Paper and pencil - cadastre' will have gone!** 

Explanation: Digital technology will be a prerequisite for efficient and adequate service.

Evaluation: In digital cadastre programme, the traditional plane tabling method has been replaced by numerical cadastral mapping using total station instruments. The raw data captured from field are managed as a separate layer. The data captured by total stations are directly transferred to PC/Laptop. After processing, cadastral database are created. The digital database could be delivered in the digital format. There is no more use of paper and pencil on this digital cadastre program. For our traditional cadastral system also there is scarce of high quality papers and pens as we were getting them from developed countries. The companies are not producing those products any more. Both due to market pull and technology push factor the use of paper and pencil will be abolished.

Observation: In my observation, there will be no more use of paper and pencil. Their will be great use of Geo-ICT tools in cadastral organization. The digital technology will be easier and faster for service delivery and one of the tools for good governance.

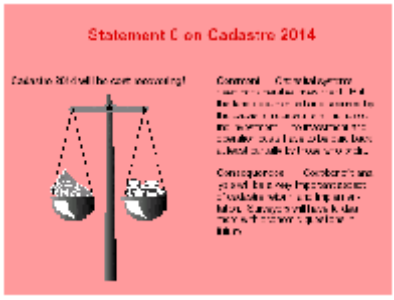
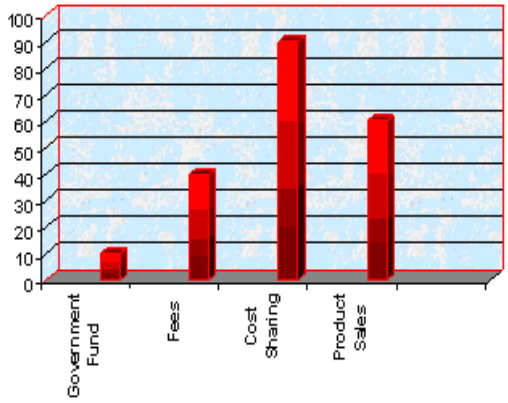
Statement	Cadastre 2014 (From Cadastre 2014 booklet)	Cadastre 2014 (From Digital Cadastre)
Five	**Cadastre 2014 will be highly privatized! Public and private sector are working closely together!**  	**Cadastre 2014 will be Public Corporations. Public –Public and Public Private coordination will be there. Cadastre 2014 will be highly decentralized** 

Explanation: Public systems tend to be less flexible and customer oriented than private organizations; the private sector can help to improve the efficiency, flexibility and introduce innovative solutions while the public sector can concentrate on supervision and control.

Evaluation: There is not the direct involvement of private sectors for digital cadastre in Nepal; but for data modeling and system development, there is the involvement of private sectors. There is the provision of licensed surveyor in the in the Land (Survey and Measurement) Act, 1963. Our experience shows that some of the jobs like cadastral surveying, database preparation, information system development, software development, research works, and training works could be outsourced to the private sector. A robust quality control mechanism should be introduced for the works carried out by private sectors. The public sector could involve for adjudication, land registration, land ownership distribution and boundary dispute resolution. In 2014, both public and private sectors will work together. There will be public-public or public-private co-ordination.

Observation: In my observation, the Cadastre 2014 will be public corporation rather than to be highly privatized. The private sectors will involve for various jobs like cadastral surveying, database preparation, information system development, software development, research works, and training works. There will be the direct involvement of local authority (Village Development Committee or Municipality) for operational works.

Statement	Cadastre 2014 (From Cadastre 2014 booklet)	Cadastre 2014 (From Digital Cadastre)

Six	**Cadastre 2014 will be cost recovering!** 	**Cost sharing modality with local authority and private sectors**  **FUNDING MODEL**

Explanation: Cost/benefit analysis will become an important aspect of cadastral reform projects and the considerable investments need to be justified. Cadastre 2014 will cover its running cost which is anyway to be covered by registration and transaction fees and contribute to a return of investment (ROI).

Evaluation: The financial matter is very much important for digital cadastre as the program is expensive in the beginning. It provides quality products and services and mainly focused for urban areas so the land owners will be ready to pay for the value of products and services. The local authority and utilities company also need cadastral data hence through the cost sharing modality the program will be sustained.

Observation: In my observation, the Cadastre 2014 will be public corporation rather than to be highly privatized. Their will be involvement of local authority, private sectors and utility companies (Telecommunication, water supply, cable lines, gas supply etc.). The running costs, which are anyway to be covered by registration and transaction fees.

5. CONCLUSIONS

Due to the technological innovations and customer's need Cadastral Survey Branch under SD has initiated digital cadastre programme in urban areas where the value and price of land is very high. There are various ways for the evaluation of cadastral system or cadastral projects. In this paper the digital cadastre programme has been evaluated with the six vision statements of Cadastre 2014 report although the vision was developed focusing the future cadastral system of developed countries. Coming on the half of the way, the vision is very much relevant in the case of cadastral projects supported by ICT in developing countries too. From this, assessment it could be concluded that the digital cadastre programme run by Cadastral Survey Branch of Survey Department will be one of the strategy of Survey Department for land tenure security and sustainable land management in Nepal.

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BIOGRAPHICAL NOTES

Dev Raj Paudyal (37) is a Survey Officer in Cadastral Survey Branch, Survey Department, Govt. of Nepal and part-time Faculty Member in School of Environmental Management and Sustainable Development (SchEMS) under Pokhara University. He has Completed M. Sc. Degree in Geoinformation Management (GIM2) from ITC, the Netherlands. He had worked in Remote Sensing Section of Topographical Survey Branch and as a Team Leader in GPS survey for “Nepal - India Boundary Survey” works. Now he is working in the Digital Cadastre Section of Cadastral Survey Branch and actively involving for Cadastral Information System Development. He has 12 years of professional experience and more than 15 publications in GI domain. His research interests are Land Administration, SDI, and Data Modeling.

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